CLAIMS

- 1 1. A microcavity structure comprising two or more microcavity waveguides, wherein one
- 2 or more microcavity active regions are created by the overlap of said microcavity
- 3 waveguides.
- 1 2. The microcavity structure of claim 1, wherein said microcavity overlap is defined by
- 2 crossing of at least two of the said microcavity waveguide at an angle.
- 1 3. The microcavity structure of claim 1, wherein each waveguide includes at least two
- 2 optical reflectors.
- 1 4. The microcavity structure of claim 3 wherein the optical reflector component
- 2 comprises of a variation in material refractive index in order to change the direction of
- 3 the incident optical energy.
- 1 5. The microcavity structure of claim 4 wherein the optical reflector could be, but is not
- 2 restricted to, a structure with a periodic change in the refractive index such as a photonic
- 3 crystal.
- 1 6. The microcavity structure of claim 3, wherein the optical reflectors surround the active
- 2 microcavity regions.
- 7. The microcavity structure of claim 3, wherein one or more of the optical reflectors are
- 2 less reflective to define one or more output paths of the generated light.

- 1 8. A microcavity structure of claim 1, wherein the microcavity waveguides provide
- 2 means for material continuity to achieve the conduction of current to the active
- 3 microcavity overlap regions.
- 1 9. The microcavity structure of claim 1, wherein said microcavity waveguides comprise
- 2 means for electrical activation.
- 1 10. The microcavity structure of claim 9 further comprising at least one contact pad that
- 2 is coupled to each of the microcavity waveguides so as to apply voltage across said
- 3 microcavity structures.
- 1 11. The microcavity structure of claim 10, wherein the top waveguide comprises p-
- 2 doped material and the bottom waveguide comprises n-doped material.
- 1 12. The microcavity structure of claim 10, wherein the top waveguide comprises n-doped
- 2 material and the bottom waveguide comprises p-doped material.
- 1 13. The microcavity structure of claim 1 further comprising a mechanism to provide
- 2 carrier confinement in the active overlap regions by converting the material under portion
- 3 of the upper waveguide into an insulator.
- 1 14. The microcavity structure of claim 1, wherein at least one of the microcavity
- 2 waveguides comprises active material used in the generation of photons.
- 1 15. A microcavity structure in claim 1, wherein the active material is composed of
- 2 quantum wells and/or quantum dots.

- 1 16. The microcavity structure of claim 1, wherein at least one of said microcavity
- 2 waveguides is used to guide light.
- 1 17. A method of forming a microcavity structure comprising:
- 2 providing two or more microcavity waveguides; and
- forming one or more microcavity active regions by overlapping said microcavity
- 4 waveguides.
- 1 18. The method of claim 17, wherein said microcavity overlap is defined by crossing of
- 2 at least two of the said microcavity waveguide at an angle.
- 1 19. The method of claim 17, wherein each waveguide includes at least two optical
- 2 reflectors.
- 1 20. The method of claim 19, wherein the optical reflector component comprises of a
- 2 variation in material refractive index in order to change the direction of the incident
- 3 optical energy.
- 1 21. The method of claim 20, wherein the optical reflector could be, but is not restricted
- 2 to, a structure with a periodic change in the refractive index such as a photonic crystal.
- 1 22. The method of claim 19, wherein the optical reflectors surrounds the active
- 2 microcavity regions.
- 1 23. The method of claim 19, wherein one or more of the optical reflectors are less
- 2 reflective to define one or more output path of the generated light.

- 1 24. A method of claim 17, wherein the microcavity waveguides provide means for
- 2 material continuity to achieve the conduction of current to the active microcavity overlap
- 3 regions.
- 1 25. The method of claim 17, wherein said microcavity waveguides comprise means for
- 2 electrical activation.
- 1 26. The method of claim 25 further comprising providing at least one contact pad that is
- 2 coupled to each of the microcavity waveguides so as to apply voltage across said
- 3 microcavity structures.
- 1 27. The method of claim 25, wherein the top waveguide comprises p-doped material and
- 2 said bottom waveguide comprises n-doped material.
- 1 28. The method of claim 25, wherein the top waveguide comprises n-doped material and
- 2 the bottom waveguide comprises p-doped material.
- 1 29. The method of claim 17 further comprising providing a mechanism to provide carrier
- 2 confinement in the active regions by converting the material under portion of the upper
- 3 waveguide into an insulator.
- 1 30. The microcavity structure of claim 17, wherein at least one of said first and second

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- 2 waveguides comprises active material used in the generation of photons.
- 1 31. A microcavity structure in claim 17, wherein the active material is composed of
- 2 quantum wells and/or quantum dots.

- 1 32. The microcavity structure of claim 17, wherein at least one of said first and second
- 2 waveguides is used to guide light.
- 1 33. A microcavity structure comprising:
- a first waveguide including a first photonic crystal microcavity; and
- a second waveguide including a second photonic crystal microcavity; and
- 4 a microcavity active region that is created by overlapping said first and second
- 5 microcavities.
- 1 34. The microcavity of claim 33, wherein the photonic crystal surrounds the active
- 2 microcavity region.
- 1 35. The microcavity structure of claim 33, wherein one or more of the photonic crystals
- 2 are less reflective to define a single or multiple output path of the generated light.
- 1 36. The microcavity structure of claim 33, wherein the first and second waveguides
- 2 provide means for material continuity to achieve the conduction of current to the active
- 3 microcavity overlap region.
- 1 37. The microcavity structure of claim 33, wherein said first waveguide and second
- 2 waveguide comprise means for electrical activation.
- 1 38. The microcavity structure of claim 37 further comprising at least one contact pad that
- 2 is coupled to said first waveguide and at least one contact pad that is coupled to said
- 3 second waveguide so as to apply voltage across said microcavity structure.

- 1 39. The microcavity structure of claim 37, wherein said first waveguide comprises p-
- 2 doped material and said second waveguide comprises n-doped material.
- 1 40. The microcavity structure of claim 37, wherein said first waveguide comprises n-
- 2 doped material and said second waveguide comprises p-doped material.
- 1 41. The microcavity structure of claim 33 further comprising a mechanism to provide
- 2 carrier confinement to the active region by converting the material under portion of the
- 3 upper waveguide into an insulator.
- 1 42. The microcavity structure of claim 33, wherein at least one of said first and second
- 2 waveguides is used to guide light.
- 1 43. The microcavity structure of claim 33, wherein at least one of said first and second
- 2 waveguides comprises active material used in the generation of photons.
- 1 44. The microcavity structure of claim 43, wherein said active material comprises
- 2 quantum wells and/or quantum dots.
- 1 45. The microcavity structure of claim 42, wherein said first waveguide guides generated
- 2 light and said second waveguide comprises active material used in the generation of
- 3 photons.
- 1 46. The microcavity structure of claim 45, wherein said active material comprises
- 2 quantum wells and/or quantum dots.
- 1 47. The microcavity structure of claim 45, wherein said first waveguide comprises p-
- 2 doped material and said second waveguide comprises n-doped material.

- 1 48. The microcavity structure of claim 45, wherein said first waveguide comprises n-
- 2 doped material said second waveguide comprises p-doped material.
- 1 49. The microcavity structure of claim 42, wherein said second waveguide guides
- 2 generated light and said first waveguide comprises active material used in the generation
- 3 of photons.
- 1 50. The microcavity structure of claim 49, wherein said active material comprises
- 2 quantum wells and/or quantum dots.
- 1 51. The microcavity structure of claim 49, wherein said first waveguide comprises p-
- 2 doped material and said second waveguide comprises n-doped material.
- 1 52. The microcavity structure of claim 49, wherein said first waveguide comprises n-
- 2 doped material said second waveguide comprises p-doped material.
- 1 53. A method of forming a microcavity structure comprising:
- 2 forming a first waveguide including a first photonic crystal microcavity; and
- forming a second waveguide including a second photonic crystal microcavity; and
- 4 forming a microcavity active region that is created by overlapping said first layer
- 5 and second microcavities.
- 1 54. The method of claim 53, wherein the photonic crystal surrounds the active
- 2 microcavity region.
- 1 55. The method of claim 53, wherein one or more of the photonic crystals are less
- 2 reflective to define a single or multiple output path of the generated light.

- 1 56. The method of claim 53, wherein the first and second waveguides provide means for
- 2 material continuity to achieve the conduction of current to the active microcavity overlap
- 3 region.
- 1 57. The method of claim 53, wherein said first waveguide and second waveguide
- 2 comprise means for electrical activation.
- 1 58. The method of claim 57 further comprising at least one contact pad that is coupled to
- 2 said first waveguide and at least one contact pad that is coupled to said second waveguide
- 3 so as to apply voltage across said microcavity structure.
- 1 59. The method of claim 57, wherein said first waveguide comprises p-doped material
- 2 and said second waveguide comprises n-doped material.
- 1 60. The method of claim 57, wherein said first waveguide comprises n-doped material
- 2 and said second waveguide comprises p-doped material.
- 1 61. The method of claim 53 further comprising a mechanism to provide carrier
- 2 confinement to the active region by converting the material under portion of the upper
- 3 waveguide into an insulator.
- 1 62. The method of claim 53, wherein at least one of said first and second waveguides is
- 2 used to guide light.
- 1 63. The microcavity structure of claim 53, wherein at least one of said first and second
- 2 waveguides comprises active material used in the generation of photons.

- 1 64. The microcavity structure of claim 63, wherein said active material comprises
- 2 quantum wells and/or quantum dots.
- 1 65. The microcavity structure of claim 62, wherein said first waveguide guides generated
- 2 light and said second waveguide comprises active material used in the generation of
- 3 photons.
- 1 66. The method of claim 65, wherein said active material comprises quantum wells
- 2 and/or quantum dots.
- 1 67. The method of claim 65, wherein said first waveguide comprises p-doped material
- 2 and said second waveguide comprises n-doped material.
- 1 68. The method of claim 65, wherein said first waveguide comprises n-doped material
- 2 said second waveguide comprises p-doped material.
- 1 69. The method of claim 62, wherein said second waveguide guides generated light and
- 2 said first waveguide comprises active material used in the generation of photons.
- 1 70. The method of claim 69, wherein said active material comprises quantum wells
- 2 and/or quantum dots.
- 1 71. The method of claim 69, wherein said first waveguide comprises p-doped material
- 2 and said second waveguide comprises n-doped material.
- 1 72. The method of claim 69, wherein said first waveguide comprises n-doped material
- 2 said second waveguide comprises p-doped material.